Chapter 12 Written Work Solutions

#40 a) $2.7\text{ mol C}\left(\frac{1\text{ mol }CS_2}{5\text{ mol C}}\right) = 0.54\text{ mol }CS_2$

#41 a) $3.60\times10^2\text{ g }CH_3OH\left(\frac{1\text{ mol }CH_3OH}{32\text{ g}}\right)\left(\frac{1\text{ mol CO}}{1\text{ mol }CH_3OH}\right)\left(\frac{}{1\text{ mol}}\right) = 11.3\text{ mol CO}$

$3.60\times10^2\text{ g }CH_3OH\left(\frac{1\text{ mol }CH_3OH}{32\text{ g}}\right)\left(\frac{2\text{ mol }H_2}{1\text{ mol }CH_3OH}\right) = 22.5\text{ mol }H_2$

#42 a) $66.6\text{ g }NH_3\left(\frac{1\text{ mol }NH_3}{17\text{ g}}\right)\left(\frac{5\text{ mol }F_2}{2\text{ mol }NH_3}\right)\left(\frac{38\text{ g }F_2}{1\text{ mol }F_2}\right) = 372\text{ g }F_2$

b) $4.65\text{ g HF}\left(\frac{1\text{ mol HF}}{20\text{ g HF}}\right)\left(\frac{2\text{ mol }NH_3}{6\text{ mol HF}}\right)\left(\frac{17\text{ g }NH_3}{1\text{ mol }NH_3}\right) = 1.32\text{ g }NH_3$

c) $225\text{ g }F_2\left(\frac{1\text{ mol }F_2}{38\text{ g }F_2}\right)\left(\frac{1\text{ mol }N_2F_2}{5\text{ mol }F_2}\right)\left(\frac{66\text{ g }N_2F_2}{1\text{ mol }N_2F_2}\right) = 78.2\text{ g }N_2F_2$

#44 c) $15.0\text{ L }NH_3\left(\frac{1\text{ mole }NH_3}{22.4\text{ L }NH_3}\right)\left(\frac{1\text{ mol }Li_3N}{1\text{ mole }NH_3}\right)\left(\frac{34.7\text{ g}}{1\text{ mol }Li_3N}\right) = 23.2\text{ g }Li_3N$

#48 $15.0\text{ g }Sb_2S_3\left(\frac{1\text{ mol }Sb_2S_3}{339.9\text{ g }Sb_2S_3}\right)\left(\frac{2\text{ mol Sb}}{1\text{ mol }Sb_2S_3}\right)\left(\frac{121.8\text{ g Sb}}{1\text{ mol Sb}}\right) = 10.8\text{ g Sb}$

$Sb\ \frac{9.84\text{ g}}{10.8\text{ g}}\times100 = 91\%$

#50 a) $1.4\text{ g }HNO_3\left(\frac{1\text{ mol }HNO_3}{39\text{ g }HNO_3}\right)\left(\frac{4\text{ mol Zn}}{10\text{ mol }HNO_3}\right)\left(\frac{6.02\times10^{23}\text{ Zn atoms}}{1\text{ mol Zn}}\right) = 9.20\times10^{21}\text{ atoms}$

b) $29.1\text{ g }NH_4NO_3\left(\frac{1\text{ mol }NH_4NO_3}{80\text{ g }NH_4NO_3}\right)\left(\frac{4\text{ mol Zn}}{1\text{ mol }NH_4NO_3}\right)\left(\frac{65.4\text{ g Zn}}{1\text{ mol Zn}}\right) = 95.1\text{ g Zn}$

#52 a) $50.0\text{ g }SiO_2\left(\frac{1\text{ mol }SiO_2}{60.1\text{ g}}\right)\left(\frac{1\text{ mol SiC}}{1\text{ mol }SiO_2}\right)\left(\frac{40.1\text{ g SiC}}{1\text{ mol SiC}}\right) = 33.4\text{ g SiC}$

b) $50.0\text{ g }SiO_2\left(\frac{1\text{ mol }SiO_2}{60.1\text{ g }SiO_2}\right)\left(\frac{2\text{ mol CO}}{1\text{ mol }SiO_2}\right)\left(\frac{28\text{ g CO}}{1\text{ mol CO}}\right) = 46.6\text{ g CO}$

$\frac{32.2\text{ g}}{33.4\text{ g}}\times100 = 96\%$

#54 $228\,g\ NH_4NO_3 \left(\frac{1\,mol\ NH_4NO_3}{80\,g}\right)\left(\frac{7\,moles\ of\ gas}{2\,mol\ NH_4NO_3}\right)\left(\frac{22.4\,L}{1\,mol\ gas}\right) = 223\,L\ gas$

#56 A $\xrightarrow{40\%}$ B $\xrightarrow{50\%}$ C $\xrightarrow{25\%}$ D $\xrightarrow{10\%}$ E $\xrightarrow{20\%}$ F

10.0 mol → 4.00 mol → 2 mol → 0.5 mol → 0.05 mol → 0.01 mol

#57 $63/55 \times 100 = 115\%$ > Outside contamination
> unreacted reactant (incomplete Rxn)

#60 $1250\,Km \left(\frac{1\,L\ Gas}{9.2\,Km}\right)\left(\frac{1000\,cm^3}{1\,L}\right)\left(\frac{0.69\,g\ Gas}{1\,cm^3}\right)\left(\frac{1\,mol\ Gas}{114\,g}\right)\left(\frac{25\,mol\ O_2}{2\,mol\ Gas}\right)\left(\frac{22.4\,L\ O_2}{1\,mol\ O_2}\right)\left(\frac{1\,L\ Air}{0.21\,L\ O_2}\right) = 1.1\times10^6\,L\ Air$

#61 (13 days) $1.0\times10^3\,Kg\ Glucose \left(\frac{1000\,g\ Glu}{1\,Kg\ Glu}\right)\left(\frac{1\,mol\ Glu}{180\,g\ Glu}\right)\left(\frac{2\,mol\ Alc}{1\,mol\ Glu}\right)\left(\frac{5\,hr}{8\,Kg\ Al.}\right)\left(\frac{46\ Alc}{1\,mol\ Alc}\right)\left(\frac{1\,Kg}{1000\,g}\right)\left(\frac{1\,day}{24\,hr}\right) =$

#62 $1004.0\,g\ CaCO_3 \left(\frac{95\,g\ CaCO_3}{100\,g\ sample}\right)\left(\frac{1\,mol\ CaCO_3}{100.1\,g}\right)\left(\frac{1\,mol\ CO_2}{1\,mol\ CaCO_3}\right)\left(\frac{44\,g\ CO_2}{1\,mol\ CO_2}\right)\left(\frac{1}{225\,L}\right) = 1.8633\,g/L$

#63 $81.8\,g\ CaCl_2 \left(\frac{1\,mol\ CaCl_2}{111.1\,g\ CaCl_2}\right)\left(\frac{1\,mol\ CaCO_3}{1\,mol\ CaCl_2}\right)\left(\frac{100.1\,g\ CaCO_3}{1\,mol\ CaCO_3}\right) = \frac{73.7}{84.4} \times 100 = 87.3\%\ CaCO_3$

#64 $2MnO_2 + 4KOH + O_2 + Cl_2 \longrightarrow$ (1.15, 1.78, 3.125, 1.4)

$100.0\,g\ MnO_2 \left(\frac{1\,mole}{86.9\,g}\right) = 1.15\,mol\ MnO_2$ $\qquad$ $100.0\,g\ O_2 \left(\frac{1\,mol}{32\,g}\right) = 3.125$

$100\,g\ KOH \left(\frac{1\,mol}{56.1\,g}\right) = 1.78\,mol\ KOH$ $\qquad$ $100.0\,g\ Cl_2 \left(\frac{1\,mol}{70.0}\right) = 1.4$

$O_2 + Cl_2$ are clearly excessive for $MnO_2 + KOH$ $\quad \frac{1}{2} = \frac{2\,MnO_2}{4\,KOH}$ $\quad \frac{1.15}{1.78}$ $\quad \frac{1}{1.5}$

KOH

#65 a) $454\,g\ Fe_2O_3 \left(\frac{1\,mol\ Fe_2O_3}{159.6\,g\ Fe_2O_3}\right)\left(\frac{2\,mol\ Fe}{1\,mol\ Fe_2O_3}\right)\left(\frac{55.8\,g\ Fe}{1\,mol\ Fe}\right) = 317\,g\ Fe$

b) $454\,g\ Fe_2O_3 \left(\frac{1\,mol\ Fe_2O_3}{159.6\,g\ Fe_2O_3}\right)\left(\frac{3\,mol\ CO_2}{1\,mol\ Fe_2O_3}\right)\left(\frac{28\,g\ CO_2}{1\,mol\ CO_2}\right) = 239\,g\ CO$

#66. $20.0\,g\ FeS_2 \left(\frac{1\,mol\ FeS_2}{120\,g}\right) = 0.2\,mol\ FeS_2$ $\quad 16.0\,g\ O_2 \left(\frac{1\,mol\ O_2}{32\,g}\right) = 0.5\,mol\ O_2$

From equation $\frac{4\ FeS_2}{11\ O_2} = \frac{1\ FeS_2}{2.75\ O_2}$ $\quad$ From Given $\frac{0.2}{0.5} = \frac{1\ FeS_2}{2.5\ O_2}$

O_2 is limiting

$16.0\,g\ O_2 \left(\frac{1\,mol\ O_2}{32\,g\ O_2}\right)\left(\frac{8\,mol\ SO_2}{11\,mol\ O_2}\right)\left(\frac{2\,mol\ SO_3}{2\,mol\ SO_2}\right)\left(\frac{80.1\,g}{1\,mol\ SO_3}\right) = \boxed{29.1\,g\ SO_3}$

#76. a) Silicon Dioxide
b) Potassium Sulfate
c) Carbonic acid
d) Magnesium Sulfide

#77 a) $Al_2(CO_3)_3$ b) NO_2 c) K_2S d) $MnCrO_4$ e) $NaBr$

#79 $147\,g\ Beryl \left(\frac{27.0\,g\ Be}{504\,g\ Be_3Al_2Si_6O_{18}}\right) = 213\,g\ Be$

#80 $26.7\,g\ C \left(\frac{1\,mol}{12\,g}\right) = \frac{2.23\,mol\ C}{2.2}$

$2.2\,g\ H \left(\frac{1\,mol}{1\,g}\right) = \frac{2.2\,mol\ H}{2.2}$

$71.1\,g\ O \left(\frac{1\,mol}{16\,g}\right) = \frac{4.44\,mol\ O}{2.2}$

Empirical CHO_2

Molecular $\frac{90}{45} = 2$ $\quad (C_2H_2O_4)$

#82 a) $2Pb(NO_3)_{2(s)} \xrightarrow{\Delta} 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

b) $C_3H_7OH_{(aq)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$

c) $2Al_{(s)} + 3FeO_{(s)} \xrightarrow{\Delta} Al_2O_{3(s)} + 3Fe_{(s)}$

Pg 383 2-10 even

#2 $6.20g\ P_4 \left(\frac{1mol\ P_4}{124g\ P_4}\right)\left(\frac{6mol\ F_2}{1mol\ P_4}\right)\left(\frac{38g}{1mol\ F_2}\right) =$ (A)

#4 $3P_2 + O_2 \rightarrow 2P_3Q$

	Statement 1	Statement 2
#6	True	True, but doesn't necessarily explain Statement 1
#8	True	True
#10	False	False

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